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Improved success rates for students studying Programming

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Introduction

There is a national crisis in the teaching and learning of Programming. This is well documented in the conferences organised by the LTSN National Subject Centre for the Information and Computer Sciences. It was recognised that this problem was particularly acute in what was then the University of North London. A major project was initiated in February 2002 to tackle this problem. This involved input from the Learning Technology Research Institute [LTRI] to develop a solution to the problems, guided by relevant research findings. The project initiated substantial changes to the curriculum supported by a major new online teaching and learning environment[1].

Description of the project

At the start of the project, a baseline was established for the pass rates in Introductory Programming modules over the previous three years. The pass rates were low, and, disturbingly, were getting worse on a year-by-year basis. In 2001/02 only 59% of the BSc students who sat the examination passed the Programming module. The downward trend was correlated with strong increases in the number of students recruited into Computing over the three-year period.

Learning to program effectively is a central enabling skill for other Computing modules. The national situation showed that even universities with very high entry qualifications were having problems in this area. There were clearly pedagogically issues that need to be tackled in developing a new, more effective teaching and learning environment for Programming. It seemed clear that good online learning resources should be part of the solution. The Director of the LTRI agreed to head a development team that would plan and implement changes to substantially improve the learning environment, and hence the success rates on the Programming modules.

The need to create 'critical mass' to enable effective development of new resources was established from the beginning. It was thus agreed that the new approach and resources would be used in HND, BSc and conversion MSc courses. The combined number of students affected was over 600 students. The three tutors for these modules worked in the development team together with a multimedia developer from the university's Teaching and Learning Technology Centre [TLTC] and a research fellow from the LTRI. The primary

responsibility of the research fellow has been to conduct an extensive evaluation of the changes introduced.

The group carried out significant developments in three main areas:

A common **curriculum** (syllabus) was established that, as far as possible, could be used in the three modules. The use of a common curriculum allowed the concentration of resources that were traditionally dissipated in parallel development of course material. Interactive visualization was used extensively to introduce topics that the students otherwise found very abstract and difficult to grasp. This was supported by special online multimedia learning resources developed by the tutors working with the TLTC multimedia developer.

A second major activity was to plan and implement improvements to the **organizational environment**. This included issues such as getting the students over the crucial first few weeks of the course, more effective use of tutorial assistants [TAs], and better co-ordination between lectures and TA activity in thecomputer laboratory. The main job of the TAs is cover the labs and to mark coursework for their groups. One of the significant changes in the project was to achieve a ratio of 1 TA to 15 students per group.

The third major activity was building a major new **online learning environment**. This included the development of substantial learning and course support materials delivered through WebCT, the university's 'virtual learning environment'. This activity also involved work in developing a set of innovative multimedia learning resources. These attractive resources are available over the Web; the students can access them from the labs or from their homes. The design ideas feeding into these resources were recognised in an 'outstanding paper' award at a recent international conference.

Evaluation and results

A thorough evaluation of the project has been (and continues to be) conducted. The evaluation includes:

- gathering information on the students' responses to the new developments – through observation, questionnaires, and interviews;
- extensive logging and monitoring of the use of the online resources; and
- investigation of the impact on success/fail rates in the modules concerned.

Only the module pass/fail results are reported here. The results show a marked improvement in pass rates. For those who completed the modules and sat the examinations, there was a 15 percentage-point improvement in the pass rate for BSc students, 19 percentage-point improvement for HND students, and 12 percentage-point improvement for MSc conversion students.

This equates to an increase of 82 students who passed the module. These figures are derived by comparing the actual number of students who passed compared with those who would have been expected to pass based on the

previous year's results. The calculations are conservative, as they do not take account of improvements in retaining more students to sit the examinations.

The lead tutor worked on the development phase of the project up to late July 2002, and then took up a post at Bolton Institute where a similar set of changes was introduced, with a similar dramatic improvement in the pass rate. It is intended to continue the project into next academic year in order to build on the results obtained.

NOTE

[1] Short version of a full paper to be published as: Boyle, T. (2003). Design principles for authoring dynamic, reusable learning objects. *Australian Journal of Educational Technology*, 19(1), 46-58.

Biographical note

Professor Tom Boyle (B.A., PhD, MSc, C.Psychol., AFBPsS) is Director of the Learning Technology Research Institute [LTRI] at London Metropolitan University (see http://www.londonmet.ac.uk/ltri). His research interests include the design of e-Learning environments, learning objects and standards, and multimedia systems development. He has published a book and over one hundred journal and conference papers on learning technology. He holds the national position of Assistant Director, with responsibility for Pedagogy, in the LTSN Subject Centre for Information and Computing Sciences. He has acted as a consultant to the Open University on eLearning and been an invited speaker at the Annual Conference of the Professors and Heads of Computing.
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